PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Kenneth W. Marr

Serial No.: 09/277,893

Filed: March 29, 1999

For: SEMICONDUCTOR FUSES, SEMICONDUCTOR DEVICES CONTAINING THE SAME, AND METHODS OF MAKING AND USING THE SAME

Confirmation No.: 4223

Examiner: N. Drew Richards

Group Art Unit: 2815

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REPLY BRIEF

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Attn: Board of Patent Appeals & Interferences

Sirs:

This Reply Brief follows the Examiner's Answer in the above-referenced application, and should be deemed to have been submitted within two months of the May 02, 2007, mailing date of the Examiner's Answer. 37 C.F.R. § 41.41; 37 C.F.R. § 1.7.

7. ARGUMENT

(A) REJECTIONS UNDER 35 U.S.C. § 103

(1) APPLICABLE LAW

In rejecting claims under 35 U.S.C. § 103(a), the Examiner is required to provide "some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." *In re Kahn,* 441 F.3d 977 (CA Fed. 2006) (cited by KSR International Co. v. Teleflex Inc., 550 U.S. ___ (2007) (slip opinion, at 14).

(2) REFERENCES RELIED UPON

Fischer

Fischer teaches a fuse for use in a semiconductor device structure, as well as a process for fabricating the fuse. The fuse of Fischer, which is disposed over an insulative structure (*i.e.,* dielectric 10) (*see, e.g.,* FIGs. 1-4; col. 2, lines 29-36), includes a first conductive layer 11 and a second conductive layer 12. The first conductive layer 11 of the finished fuse may be formed from aluminum or tungsten (col. 2, lines 43-45) and includes two end regions (FIG. 3). The second conductive layer 12 of the fuse may be formed from the same material as the first layer 11 or from polysilicon. Col. 2, lines 59-63. In a finished fuse, such as that illustrated in FIG. 3 of Fischer, end portions of the second conductive layer 12 overlie the two end regions of the first conductive layer 11, while the central portion 111 of the second conductive layer 12 is located in substantially the same plane as the first conductive layer 11 and between portions of the first conductive layer 11. *See also,* col. 2, lines 56-58.

Fischer teaches that the fuse is fabricated by forming a first layer of conductive material 11 over an insulative structure 10 (FIG. 1; col. 2, lines 45-48), patterning a "window" 111 in the first layer of conductive material to expose a portion of the underlying insulative structure (FIG. 1; col. 2, lines 36-38; col. 3, lines 34-55), forming a second layer 12 of conductive material over the first layer 11 and within the window 111 (FIG. 2; col. 2, lines 49-55), and patterning the "combined" first and second layers to form the fuse (FIG. 3; col. 2, lines 56-58).

The teachings of Fischer are limited to methods for fabricating a multi-layer fuse, the upper layer of which is configured to be "blown" to program the fuse. None of the layers of that fuse comprises metal silicide. Nor does Fischer provide one of ordinary skill in the art with any motivation to use metal silicide to form one of the layers of the fuse described therein.

Chen

Chen also teaches a fuse and a method for fabricating the fuse. The fuse of Chen may be formed from aluminum, titanium tungsten, a silicide or polycide, or polysilicon (col. 5, lines 59-63), but only includes a single material layer.

A portion of the fuse described in Chen is exposed by way of a so-called fuse "window." *See, e.g.,* col. 4, lines 50-54. This "window" facilitates programming of the fuse with a laser. *See* col. 7, lines 38-40. In order to prevent contamination of the fuse prior to programming thereof, as well as to prevent contamination of the underlying semiconductor device features following programming of the fuse, Chen teaches a method for forming a moisture barrier both above and beneath the window of the fuse.

Mitani

Mitani teaches a fuse with lower layer that is formed from polycrystalline silicon and an upper layer with spaced apart regions that are formed from a metal silicide, as well as methods for fabricating such a fuse. Mitani, Abstract. In the fabrication method, the polycrystalline silicon is first deposited on a field oxide. *Id.* Next, a layer of metal silicide is formed over the polycrystalline silicon, and the layers are etched in combination to define a periphery of the fuse. *Id.* Finally, the intermediate part of the metal silicide is etched, leaving only polycrystalline silicon as the central region of the finished fuse, the portion of the fuse that is to be ruptured. *Id.*

Sandhu

Sandhu teaches a process for depositing a tungsten silicide film on a substrate using chemical vapor deposition (CVD).

Degelormo

Degelormo merely teaches a CVD method for forming layers of conductively doped polysilicon. Degelormo includes no teaching or suggestion that the CVD process thereof may be used to fabricate any part of a fuse or structures associated directly with a fuse.

Ukeda

Ukeda teaches a dry etch process for anisotropically removing exposed regions of a polysilicon layer through a metal silicide layer. Ukeda does not teach or suggest that the process disclosed therein may be used to fabricate a fuse.

(3) ANALYSIS

(a) Fischer in View of Chen

Claims 17, 19-24, 26-33, 102, and 103 have been rejected under 35 U.S.C. § 103(a) for reciting subject matter which is assertedly unpatentable over the subject matter taught in Fischer, in view of teachings from Chen.

It is respectfully submitted that a *prima facie* case of obviousness has not been established with respect to the subject matter recited in any of claims 17, 19-24, 26-33, 102, and 103.

The teachings of Fischer are limited to methods for fabricating fuses with multiple conductive layers, none of which includes a silicide. In fact, the teachings and suggestions of Fischer are limited to use of aluminum, tungsten, or polysilicon for the programmable portion 12 of the fuse. Col. 2, lines 43-45, 59-63. Neither Fischer nor Chen provides one of ordinary skill in the art with any reason to substitute a silicide for one of the conductive layers of the fuse of Fischer.

The teachings of Chen are limited to fuses that comprise a single layer of sicilide. Neither Chen nor Fischer provides any teaching or suggestion that would have provided one of ordinary skill in the art with any reason to add an additional layer of conductive material at either

terminal end of the silicide fuse taught in Chen. Such a modification would have unnecessarily increased the complexity of the fuse fabrication process of Chen.

From the teachings of Fischer and Chen, it is apparent that without the benefit of hindsight that the claims and disclosure of the '893 Application have provided to the Examiner, one of ordinary skill in the art wouldn't have been motivated to combine the teachings of Fischer and Chen in the manner that has been asserted. Further, no teachings that were generally available to those of ordinary skill in the art at the appropriate time have been supplied to show otherwise.

Moreover, by touting aluminum as advantageous and tungsten as a promising alternative for use in forming the programmable portion of the fuse described therein, Fischer teaches that there would be no reason to substitute a silicide for one of these materials in the programmable portion of a fuse.

Therefore, the Examiner has not set forth a convincing line of reasoning as to why one of ordinary skill in the art would have been motivated to combine teachings from Fischer and Chen in such a way as to render claims 17, 19-24, 26-33, 102, and 103 unpatentable under 35 U.S.C. § 103(a).

As such, a *prima facie* case of obviousness of claims 17, 19-24, and 26-33 has not been established pursuant to the requirements of 35 U.S.C. § 103(a). Accordingly, claims 17, 19-24, 26-33, 102, and 103 are drawn to subject matter that is allowable over the teachings of Fischer and Chen.

The foregoing is merely intended to supplement the arguments that have been presented in the APPEAL BRIEF.

Reversal of the 35 U.S.C. § 103(a) rejections of claims 17-33, 50-72, 74-105 is respectfully requested.

11. CONCLUSION

It is respectfully submitted that:

(A) Claims 17, 19-24, 26-33, 102, and 103 are allowable under 35 U.S.C. § 103(a) over Fischer and Chen;

(B) Claim 18 recites subject matter which is allowable under 35 U.S.C. § 103(a) over Fischer, Chen, and Mitani;

(C) Claim 25 is allowable under 35 U.S.C. § 103(a) as reciting subject matter which is patentable over Fischer, Chen, and Sandhu;

(D) Claims 50, 51, 55-60, and 62-68 are allowable under 35 U.S.C. § 103(a) as reciting subject matter which is allowable over Fischer, Mitani, and Chen;

(E) Claims 52-54, 69, and 70 recite subject matter which is patentable under 35 U.S.C. § 103(a) over Fischer, Mitani, Chen, and Degelormo;

(F) Claim 61 is allowable for reciting subject matter which, under 35 U.S.C. § 103(a), is patentable over Fischer, Mitani, Chen, and Sandhu;

(G) Claims 71, 74-86, 88-96, 101, 104, and 105 are allowable under 35 U.S.C. § 103(a) as being patentable over Mitani, Fischer, and Chen;

(H) Claim 72 is patentable, under 35 U.S.C. § 103(a), for reciting subject matter which is allowable over the combination of Mitani, Fischer, Chen, and Degelormo;

(I) Claim 87 recites subject matter which is patentable under 35 U.S.C. § 103(a) over Mitani, Fischer, Chen, and Sandhu; and

(J) Claims 97-100 recite subject matter which is patentable under 35 U.S.C. § 103(a) as being nonobvious over Mitani, Fischer, Chen, and Ukeda.

Accordingly, reversal of the rejections of claims 17-33, 50-72, and 74-105 under 35 U.S.C. § 103(a) is respectfully solicited.

Respectfully submitted,

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